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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/089,017	07/19/2002	Ralph Wirth	12406-022001	5521

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EXAMINER
DOLAN, JENNIFER M

ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 05/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/089,017	WIRTH ET AL.	
	Examiner	Art Unit	
	Jennifer M. Dolan	2813	AW

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 February 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 6- 9, and 13-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,779,924 to Krames et al. (cited by applicant) in view of U.S. Patent No. 5,744,828 to Nozaki et al.

Regarding claims 1 and 14, Krames discloses a light emitting diode, comprising: a semiconductor layer structure including a substrate (3) and at least one light-generating layer (2) formed on the substrate (figure 7c). Krames further discloses a transparent semiconductor epitaxial layer (1), deposited on the light generating layer (figure 7c), a first electrical contact layer (4) on the back of the substrate (see figure 7c), and a second electrical contact layer (4, portion on top of layer 1) deposited on the semiconductor epitaxial layer, characterized in that the top surface of the semiconductor epitaxial layer has vertical structuring to improve the decoupling of light (figure 7c; see column 3, lines 1-20; column 6, lines 25-52). The semiconductor epitaxial layer (1) of Krames is considered to act as a current-spreading layer, since the current-spreading layer is typically a thin semiconductor layer with low resistivity, such as an AlGaAs layer, similar to that disclosed by Krames. Assuming arguendo, the epitaxial layer of Krames does not constitute a current spreading layer.

Krames further fails to disclose that the second electrical contact provides substantially uniform coupling of the current into the current spreading layer, and that the second contact layer has a circumferential contact web structure.

Nozaki discloses a LED using a transparent current spreading layer (6) and having a second electrical contact (20) with a lateral structure (figure 1) by means of which substantially uniform coupling of the electrical current into the current-spreading layer can be achieved (see column 2, lines 12-60, column 7, lines 20-30). Nozaki further teaches that the second contact layer has a circumferential web arranged about a central contact structure (figures 1 and 8).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the LED structure of Krames, such that it includes a current spreading layer and an upper electrode with a lateral structure for uniform current coupling, as taught by Nozaki. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to provide a current spreading layer and an electrode with lateral structure, because combination of the current spreading layer and laterally disposed electrode structure allows for an even current distribution across the entire surface of the light emitting layer, which results in improved luminous efficiency and brightness (see Nozaki, column 2, lines 12-60, column 7, lines 20-30).

Regarding claim 6, Krames, as modified by Nozaki, discloses that the second electrical contact layer (Krames, 4,9 adjacent to layer 1) is arranged on structured (see Krames, figs. 10-11) and/or unstructured portions of the current spreading layer (Krames, figure 7c).

Regarding claims 7 and 13, Krames discloses that the vertical structuring is in the form of regularly arranged cones (column 6, lines 25-30; figures 5a-5c). Krames further teaches that

both "sharp featured" and "soft featured" textures are known to the art (see column 4, lines 28-47).

Krames fails to specifically disclose the use of pyramidal texturing.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the texturing of Krames as modified by Nozaki, such that the texturing includes pyramids. The rationale is as follows: A person having ordinary skill in the art would have been motivated to use pyramids, because a pyramidal structure is the "sharp feature" analogous form to the specifically disclosed cones (see column 6, lines 25-30; figures 5a-5c). Although Krames teaches that the "sharp feature" forms are less desirable than the "soft feature" forms, it is quite apparent to a person skilled in the art that the use of both the "soft" and "sharp" forms are contemplated by Krames. It has been held that "A reference may be relied upon for all that it would have reasonably suggested to one having ordinary skill in the art, including nonpreferred embodiments, " *Merck & Co. V. Biocraft Laboratories*, 874 F .2d 804 10 USPQ 2d (1843). Also, it has been held that "A known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use," *In re Gurley*, 27 F.3d 551, 554, 31 USPQ2d 1130, 1132 (1994). Since the applicant provides no specific unexpected result or specific advantage to using pyramids over using cones, and since pyramids are an obvious "sharp featured" analogous structure to regularly arranged cones, their usage as a textured layer for improved light extraction would have been reasonably suggested to a person skilled in the art based on the disclosure of Krames.

Regarding claims 8 and 9, Krames discloses a method for fabricating a LED, such that a light generating layer (2) and thereafter an upper cladding layer which is considered to act as a

current spreading layer (the layer is made of AlGaAs, which is a typical current spreading material, is thick, transparent, and meets the requirements for a current spreading layer as established in the specification of the present application) are deposited on a substrate (3) and the back of the substrate is provided with a first contact layer (4). Krames further teaches both the cases where vertical structuring is performed, and then the second contact layer is deposited on the structured surface (see figures 10-13); and the case where the second contact layer with a desired lateral structure is first provided, and then vertical structuring takes place (figures 7a-7c, 8). Krames fails to specifically point out, however, that the upper cladding material is a current spreading layer. Assuming arguendo, the upper cladding material does not sufficiently act as a current spreading layer.

Nozaki discloses an LED having a light emitting layer (4) with a current spreading layer (6) provided on top.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Krames, such that a current spreading layer is provided in addition to the light emitting structure, as taught by Nozaki. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to provide a current spreading layer, because doing so helps to widely diffuse the supplied current to the whole device, thus improving light emission efficiency and brightness (see Nozaki, column 2, lines 12-18).

Regarding claims 15 and 16, Krames discloses that the vertical structuring is in the form of regularly arranged cones (column 6, lines 25-30; figures 5a-5c).

3. Claims 1-4, 10, and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nozaki et al. in view of Krames et al.

Regarding claim 1, Nozaki discloses an LED having a substrate (1) and at least one light generating layer (4) formed on the substrate and one transparent current spreading layer (6) deposited on the light generating layer (figure 2), a first electrical contact (9) on the back of the substrate (figure 2); and a second electrical contact (20, 21, 22) on the current spreading layer (figure 2), where the second electrical contact layer has a lateral structure by means of which substantially uniform coupling of the current into the current spreading layer can be achieved (figure 1; column 2, lines 12-18).

Nozaki fails to teach that the current spreading layer has vertical structuring to improve the decoupling of light.

Krames teaches an LED having ordered interface texturing (figure 7c) to improve the decoupling of light (column 2, line 65 – column 3, line 20; column 4, line 16- column 6, line 50).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the LED of Nozaki by vertically structuring the current spreading layer, as suggested by Krames. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to vertically texture the current spreading layer, because Nozaki shows that the current spreading layer is the outermost layer of the device (i.e. interfacing with air since layer 7 is removed; see Nozaki, column 5, lines 1-10), and Krames shows that texturing the outermost layer leads to improved transmission/extraction efficiency of the LED (see Krames, column 2, line 65 – column 3, line 20).

Regarding claims 2 and 10, Nozaki discloses that the second contact layer has a circular central contact surface with a contact structure rotationally symmetrical with respect to the center point of the central contact surface, and is composed of relatively narrow contact webs (figure 1).

Regarding claim 3, Nozaki shows 4-fold symmetry (figure 1).

Regarding claim 4, Nozaki shows that the second contact layer is continuous (figure 1).

Regarding claim 12, Nozaki shows that the rotational symmetry of the second contact and that of the LED are both the same (4-fold; see figure 1).

4. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nozaki et al. in view of Krames et al. as applied to claim 1 above, and further in view of U.S. Patent No. 6,107,644 to Shakuda et al.

Nozaki as modified by Krames, fails to disclose a discontinuous second electrical contact.

Shakuda discloses that the second electrical contact (8b) for an LED may be equivalently continuous (figure 6b) or discontinuous (figures 7a, 7b) and interconnected by a layer of transparent, light-conducting material (7; figure 6a).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the electrode of Nozaki as modified by Krames, such that it is discontinuous, as taught by Shakuda. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to provide a discontinuous electrode, because Shakuda shows that discontinuous and continuous electrodes may be equivalently employed for providing uniform current distribution to an LED (see Shakuda, column 2, lines 40-46; column 12, lines 21-34; figures 6b, 7a, 7b).

5. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nozaki et al. in view of Krames et al. as applied to claim 2 above, and further in view of European Patent Application 0 544 512 to Watanabo et al.

Nozaki teaches a circular central contact surface (figure 1), but fails to disclose a square shaped central contact surface.

Watanabo discloses both circular (figures 5, 7, and 9) and square shaped (figures 10, 12, and 13) central contact surfaces.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the second contact surface of Nozaki as modified by Krames, such that the central contact surface is square shaped, as taught by Watanabo. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to provide a square shaped central contact surface, because Watanabo shows that both circular and square shaped central contact surfaces are recognized art equivalents, and thus can be used interchangeably for laterally structured LED contacts (see figures 5, 7, 9, 10, 12, 13).

6. Claims 1 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Japanese Patent Publication No. 07-162037 to Nishitani in view of Nozaki et al.

Nishitani discloses a light emitting diode, comprising: a semiconductor layer structure including a substrate (101) and at least one light-generating layer (105) formed on the substrate (figure 4). Nishitani further discloses a current spreading layer (107) deposited on the light generating layer; a first electrical contact layer (109) on the back of the substrate; and a second

electrical contact layer (108) deposited on the semiconductor epitaxial layer, characterized in that the top surface of the semiconductor epitaxial layer has vertical structuring to improve the decoupling of light (see figure 4; abstract).

Nishitani fails to disclose that the second electrical contact provides substantially uniform coupling of the current into the current spreading layer, and that the second contact layer has a circumferential contact web structure.

Nozaki discloses a LED having a second electrical contact (20) with a lateral structure (figure 1) by means of which substantially uniform coupling of the electrical current into the current-spreading layer can be achieved (see column 2, lines 12-60, column 7, lines 20-30). Nozaki further teaches that the second contact layer has a circumferential web arranged about a central contact structure (figures 1 and 8).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the LED structure of Nishitani, such that it includes an upper electrode with a lateral structure for uniform current coupling, as taught by Nozaki. The rationale is as follows: One of ordinary skill in the art at the time the invention was made would have been motivated to provide a current spreading layer and an electrode with lateral structure, because a laterally disposed electrode structure allows for an even current distribution across the entire surface of the light emitting layer, which results in improved luminous efficiency and brightness (see Nozaki, column 2, lines 12-60, column 7, lines 20-30).

Response to Arguments

7. Applicant's arguments filed 2/20/04 have been fully considered but they are not persuasive.

The applicant argues that a combination of Krames or Nishitani with Nozaki would not result in a device having the structure recited in claim 1, since the resultant structure has the upper electrode disposed on the contact layer 7, rather than on the current spreading layer.

This is not persuasive, because the claim language only states that the upper electrode is disposed "on" the current spreading layer, and not 'directly on top of the current spreading layer with no intervening layers.' Even with the presence of a very thin contact layer, the electrode is still 'on' the current spreading layer, in that it is disposed on top of or above the current spreading layer. Also, layer 7 of Nozaki is simply included in order to provide a better ohmic contact between the semiconductor layers and the electrode, as is appreciated by a person skilled in the art. Although the ohmic contact layer does provide improved ohmic contact to the electrode, it is clear to a person skilled in the art that the lack of such a layer would not destroy the function of the laterally structured electrode. Since Krames does not teach an ohmic contact layer, one can deduce that a reasonably and functionally decent ohmic contact is achieved between layers 4 and 1 of Krames, and thus, one could simply take the teaching of a laterally structured electrode from Nozaki when combining the references.

The applicant further argues that an additional contact layer would complicate the manufacturing, since it requires an additional deposition and removal step.

This is not persuasive, because the combination of Krames and Nozaki does not necessitate the inclusion of an additional ohmic contact layer, as is addressed supra. Even if it is

assumed that the ohmic contact layer must be included in the combination, the argument is not persuasive, since Nozaki already teaches that steps of depositing the contact layer and removing all portions not under the electrode are not unreasonable or particularly burdensome to add to the manufacturing process (see Nozaki, column 4, line 50 – column 5, line 10). Since Nozaki shows that the current is more evenly distributed across the light emission plane by such a construction (see Nozaki, column 3, line 60 – column 4, line 17), it is reasonable for a person skilled in the art to be motivated to add the manufacturing steps in order to achieve this improvement in performance.

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Dolan whose telephone number is (571) 272-1690. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W. Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jennifer M. Dolan
Examiner
Art Unit 2813

jmd

ERIK J. KIELIN
PRIMARY EXAMINER